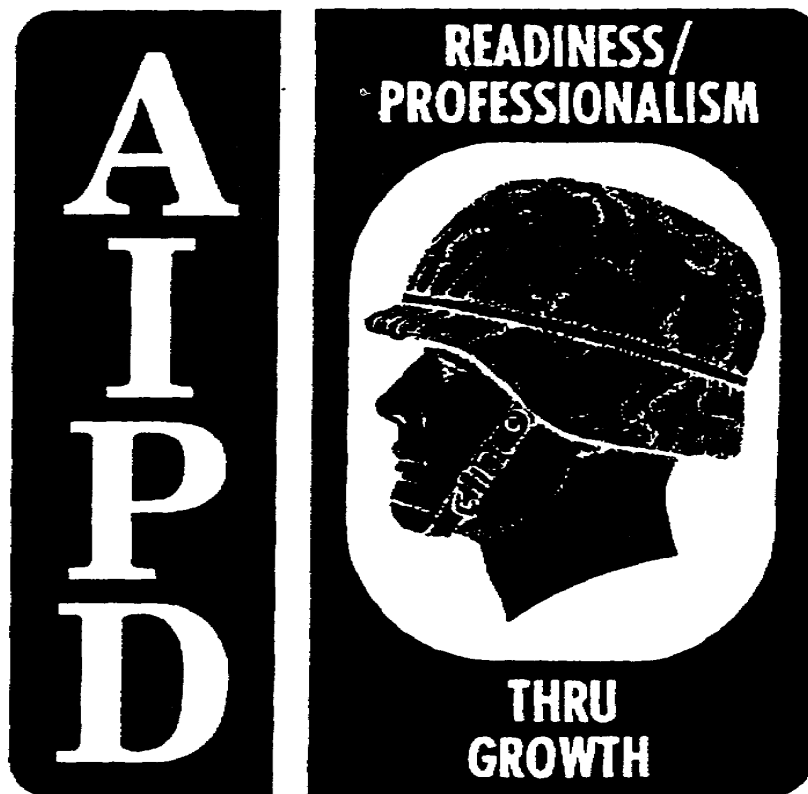


SUBCOURSE
QM3503

EDITION
A

**DIRECT FUEL SYSTEM SUPPLY
POINT OPERATIONS**



**THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT
ARMY CORRESPONDENCE COURSE PROGRAM**

DIRECT FUEL SYSTEM SUPPLY POINT OPERATIONS

Subcourse Number QM 3503

EDITION A

United States Army Combined Arms Support Command
Fort Lee, Virginia 23801-1809

5 Credit Hours

Edition Date: September 1993

SUBCOURSE OVERVIEW

This subcourse is designed to teach you how to identify the components of a fuel system supply point (FSSP); perform and supervise preventive maintenance checks and services (PMCS) on the components of an FSSP; direct site preparation, layout, and assembly of an FSSP; and perform emergency repair of collapsible storage tanks.

There are no prerequisites for this subcourse.

This subcourse reflects the doctrine which was current at the time that it was prepared. In your own work situation, always refer to the latest official publications.

Unless otherwise stated, the masculine gender of singular pronouns is used to refer to both men and women.

TERMINAL LEARNING OBJECTIVE

- ACTION: You will identify the components of an FSSP; perform and supervise PMCS on the components of an FSSP; direct site preparation, layout, and assembly of an FSSP; and perform emergency repair of collapsible storage tanks in accordance with FM 10-69.
- CONDITION: You will have information and extracts in this subcourse that were derived from FM 10-69.
- STANDARD: To demonstrate competency of this task, you must achieve a minimum of 70 percent on the subcourse examination.

TABLE OF CONTENTS

Section	Page
Subcourse Overview.....	i
Lesson: Direct Fuel System Supply Point Operations	
PART A - Organization and Operation of a Fuel System Supply Point.....	1-2
PART B - Storage and Issue of Bulk Petroleum.....	1-19
Practice Exercise.....	1-29
Answer Key and Feedback.....	1-33
Appendix A: List of Common Acronyms.....	A-1
Appendix B; Publication Extracts.....	B-1
FM 10-69 Petroleum Supply Point Equipment and Operations, October 1986	
Use the above publication extracts to take this subcourse. At the time that we wrote this subcourse, this was the current publication. In your own work situation, always refer to the latest publications.	

LESSON

DIRECT FUEL SYSTEM SUPPLY POINT OPERATIONS

Critical Tasks: 03-5103.00-0001
03-5103.00-0036

OVERVIEW

LESSON DESCRIPTION:

In this lesson, you will learn how to identify the components of an FSSP; perform and supervise PMCS on the components of an FSSP; direct site preparation, layout, and assembly of an FSSP; and perform emergency repair of collapsible storage tanks.

TERMINAL LEARNING OBJECTIVE:

ACTION: You will identify the components of an FSSP; perform and supervise PMCS on the components of the FSSP; direct site preparation, layout, and assembly of an FSSP; and perform emergency repair of collapsible storage tanks.

CONDITION: You will be given information and extracts in this lesson that were derived from FM 10-69.

STANDARD: To demonstrate competency of this task, you must achieve a minimum of 70 percent on the subcourse examination.

REFERENCE: The material contained in this lesson was derived from the following publication: FM 10-69.

INTRODUCTION

As the petroleum section supervisor, you must ensure that personnel use equipment properly and that they maintain fuel accountability in the field. To do this, you must be familiar with the operation of the FSSP. The FSSP is the Army's primary means for the receipt, storage, and issue of bulk petroleum products in a tactical environment. It is located within the Class III fuel system supply point. In this lesson, you will learn how to identify the components of an FSSP; direct site selection, layout, and assembly of an FSSP; perform and supervise PMCS; and perform emergency repair of collapsible storage tanks.

PART A - ORGANIZATION AND OPERATION OF A FUEL SYSTEM SUPPLY POINT

1. Fuel System Supply Point Components.

The FSSP is the Army's primary means for the receipt and storage of bulk petroleum and for its issue to combat forces under tactical conditions. The FSSP is not issued as a complete system. The major components are issued as separate items of equipment to add to the flexibility of the system. The number of major components depends on the size and configuration of the system. An FSSP normally consists of--

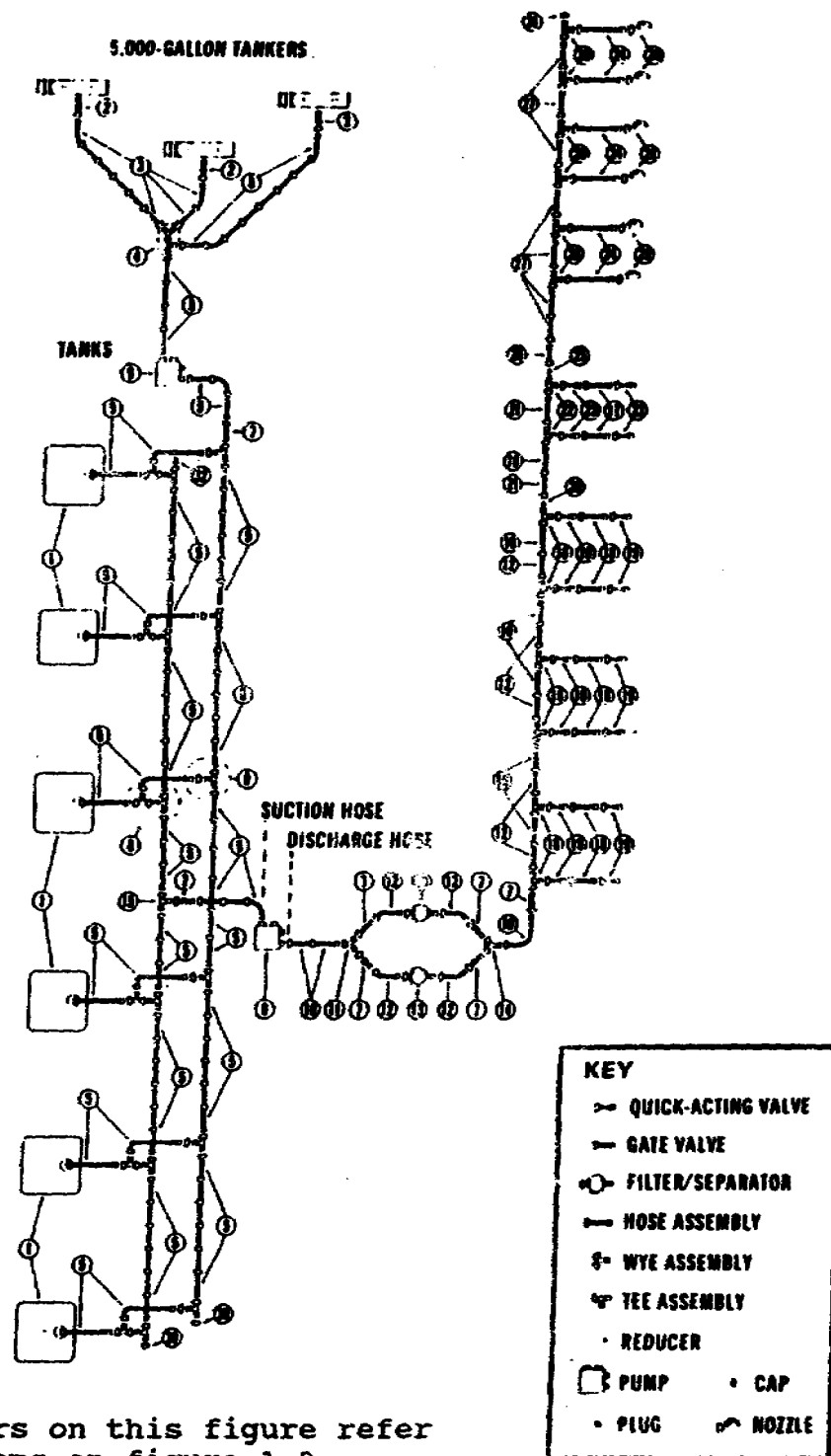
- o a receiving manifold,
- o two 350-gallons per minute (GPM) pumping assemblies,
- o two 350-GPM filter/separators,
- o six 10,000-gallon collapsible tanks,
- o six bottom loading points,
- o two 500-gallon collapsible drum filling points, and
- o six 5-gallon can and 55-gallon drum filling and vehicle refueling points.

Approximately 2,400 feet of hose and nine types of fitting assemblies connect these fuel system components. When you requisition an FSSP, you receive only the hoses, fitting assemblies, and tools to connect the above components. Figure 1-1 shows a typical FSSP layout, and Figure 1-2 lists the components.

a. Receiving Manifold. The receiving manifold consists of a wye and tee assembly (reducing from 4 to 3 inches), lengths of 3-inch suction hose, and 3-inch gate valves as shown in Figure 1-1. With this manifold, the FSSP can receive product from more than one transporter at a time. It also provides a way to switch from one supply source to another. Use grounding equipment whenever you receive fuel through the manifold, because contact between the receiving manifold and the ground is not perfect.

b. 350-GPM Pumping Assemblies. The FSSP normally has two 350-GPM pumps. Use the 350-GPM pumps to move fuel from the supply source to storage tanks. Also, use the pumps to move fuel from storage tanks to the dispensing point.

c. 350-GPM Filter/Separators. Use the vertically mounted, 350-GPM filter/separators in each FSSP to remove entrained water and solid contaminants from the fuel before pumping it into vehicles or containers. There are normally two filter/separators per supply point.



Note: The numbers on this figure refer to the items on figure 1-2.

Figure 1-1. Typical fuel system supply point layout

ITEM	DESCRIPTION	NO REQD
1.	Tank, 10,000-gallon, collapsible, petroleum	6
2.	Valve, 3" gate, flanged, with M and F CL	3
3.	Hose, suction, 3" X 12', M CL one end, F CL other	16
4.	Wye and tee assembly, flanged, M CL 3" and 4"	1
5.	Hose, suction, 4" X 10', M CL one end, F CL other	83
6.	Pump, 350 GPM, 4", with M and F CL	2
7.	Valve, gate, 4" flanged, with M and F CL	25*
8.	Manifold with two-tee fittings	6*
9.	Manifold with one-tee fitting	6*
10.	Hose, discharge , 4" X 50', with M and F CL	8
11.	Wye assembly, flanged, 4", with one F CL inlet and 2 M CL outlets	1
12.	Hose, discharge, 4" X 25', with M and F CL	9
13.	Filter/separator, 350-GPM, 4", with M and F CL	2
14.	Wye assembly, flanged, 4", with two F CL inlets and one M CL outlet	1
15.	Tee assembly, flanged, 4", with two M CL and one F CL	1
16.	Tee assembly, flanged, 4" X 3" with one 4" M CL, one 4" F CL, and one 3" M CL	6
17.	Hose, discharge, 1 1/2" X 25', M and F CL	5
18.	Hose, discharge, 3" X 25', M and F CL	4
19.	Valve, quick-acting, 3" X 25', M and F CL	12
20.	Reducer, 4" F CL X 3" M CL	1
21.	Hose, discharge, 3" X 50', M and F CL	2

Figure 1-2. Fuel system supply point components

22.	Tee assembly, flanged, 3" X 1 1/2", with one 3" F CL, one 3" F CL, one 3" M CL, and one 1 1/2" M CL	5
23.	Valve, quick-acting, 1 1/2" M and F CL	4
24.	Hose, discharge, 1" X 25', M and F CL	6
25.	Reducer, 3" F CL X 2" M CL	1
26.	Valve, quick-acting, 2", M and F CL	1
27.	Hose, discharge, 2" X 25', M and F CL	7
28.	Tee, reducing, 2" F CL X 2" M CL X 1" M CL	6
29.	Nozzle, 1", with adapter	6
30.	Dust cap for 4" CL	2
31.	Dust cap for 2" CL	1
32.	Dust plug for 4" CL	1
33.	Filler and discharge assembly	6*
34.	Vent pipe assembly	6*
35.	Drain fitting assembly	6*
The following abbreviations are used in this table:		
CL - cam-locking couplings		
M - male		
F - female		
*NOTE: Each of the six storage tanks comes with a manifold consisting of eight lengths of hose, one two-tee, one one-tee, two 4-inch gate valves, filler and discharge assembly, vent pipe assembly, and a drain fitting assembly.		

Figure 1-2. Fuel system supply point components (continued)

d. 10,000-Gallon Collapsible Tanks. The FSSP normally has six 10,000-gallon collapsible tanks to store fuel. Each tank uses one hose line manifold assembly with two-tee fittings and one hose line manifold assembly with one-tee fitting. The manifold, as shown in Figure 1-3, has two rising-stem, double-acting gate valves to control the flow of fuel into and out of the collapsible tank.

e. Bottom Loading Points. The fuel system has six 3-inch bottom loading points to load fuel into tank semitrailers. Each bottom loading point consists of a tee assembly (reducing from 4

to 3 inches) coupled to a 3-inch, cam-locking coupling valve followed by 25 feet of 3-inch discharge hose coupled to a 3-inch, cam-locking coupling valve as shown in Figure 1-1.

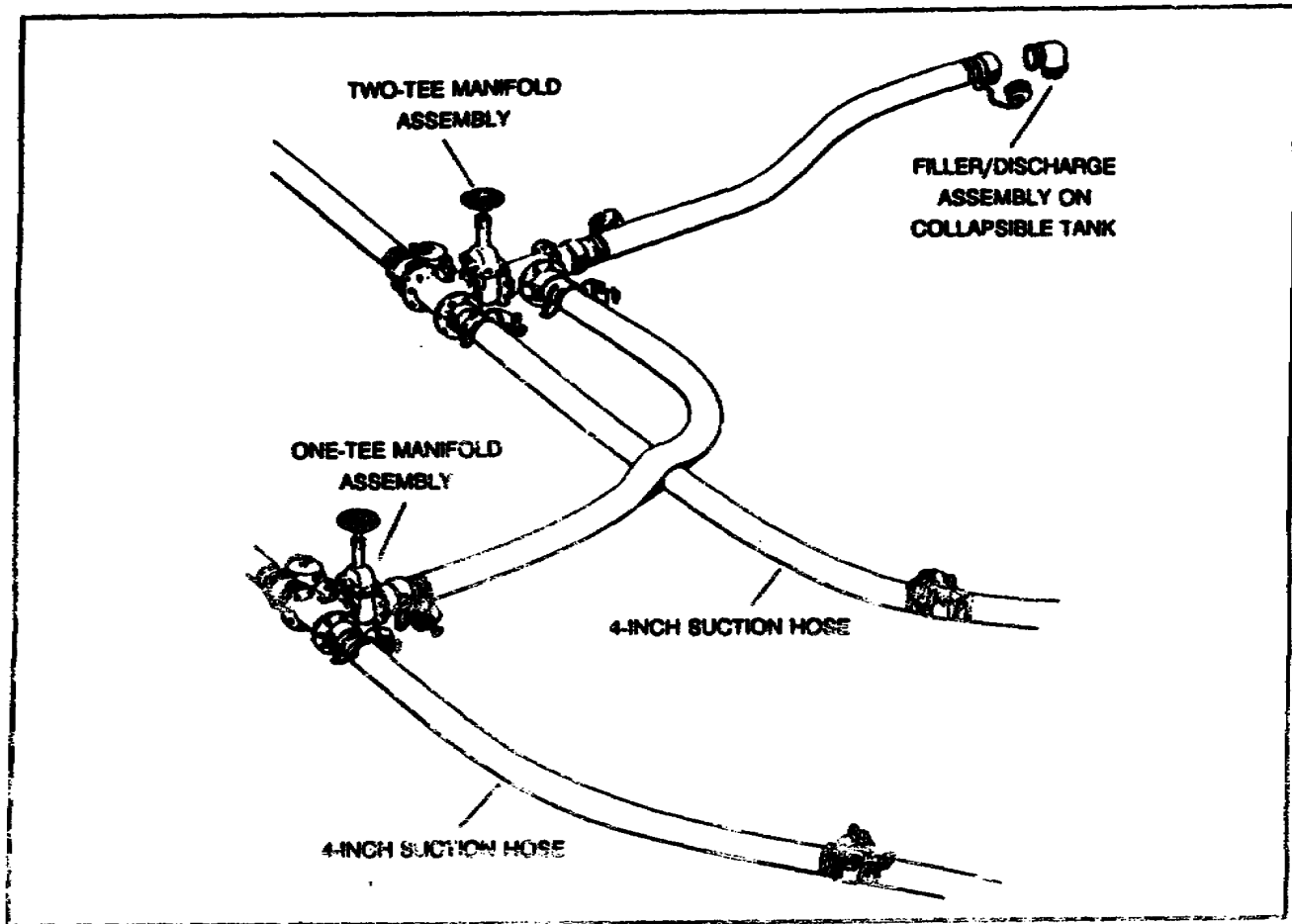


Figure 1-3. Hose line manifold assemblies

f. 500-Gallon Collapsible Drum Filling Points. There are two 500-gallon collapsible drum filling points in the FSSP. Each point consists of a tea assembly (reducing from 3 to 1 1/2 inches) coupled to a 1 1/2-inch, cam-locking coupling valve. Following this is 25 feet of 1 1/2 -inch discharge hose coupled to a 1 1/2-inch, cam-locking coupling valve as shown in Figure 1-3. You can also use the pressure control (which is not a component of the FSSP) for the filling operation. The inlet of the pressure control attaches to the downstream end of the 1 1/2-inch discharge hose. The 5-foot length of pressure control discharge hose connects from the control outlet to the drum elbow coupler valve as shown in Figure 1-1.

g. 5-Gallon Can and 55-Gallon Drum Filling and Vehicle Refueling Points. There are six 5-gallon can and 55-gallon drum filling and vehicle refueling points in the FSSP. Each point consists of a tee assembly (reducing from 2 inches to 1 inch) followed by 25 feet of 1-inch discharge hose coupled to a 1-inch aluminum nozzle as shown in Figure 1-1.

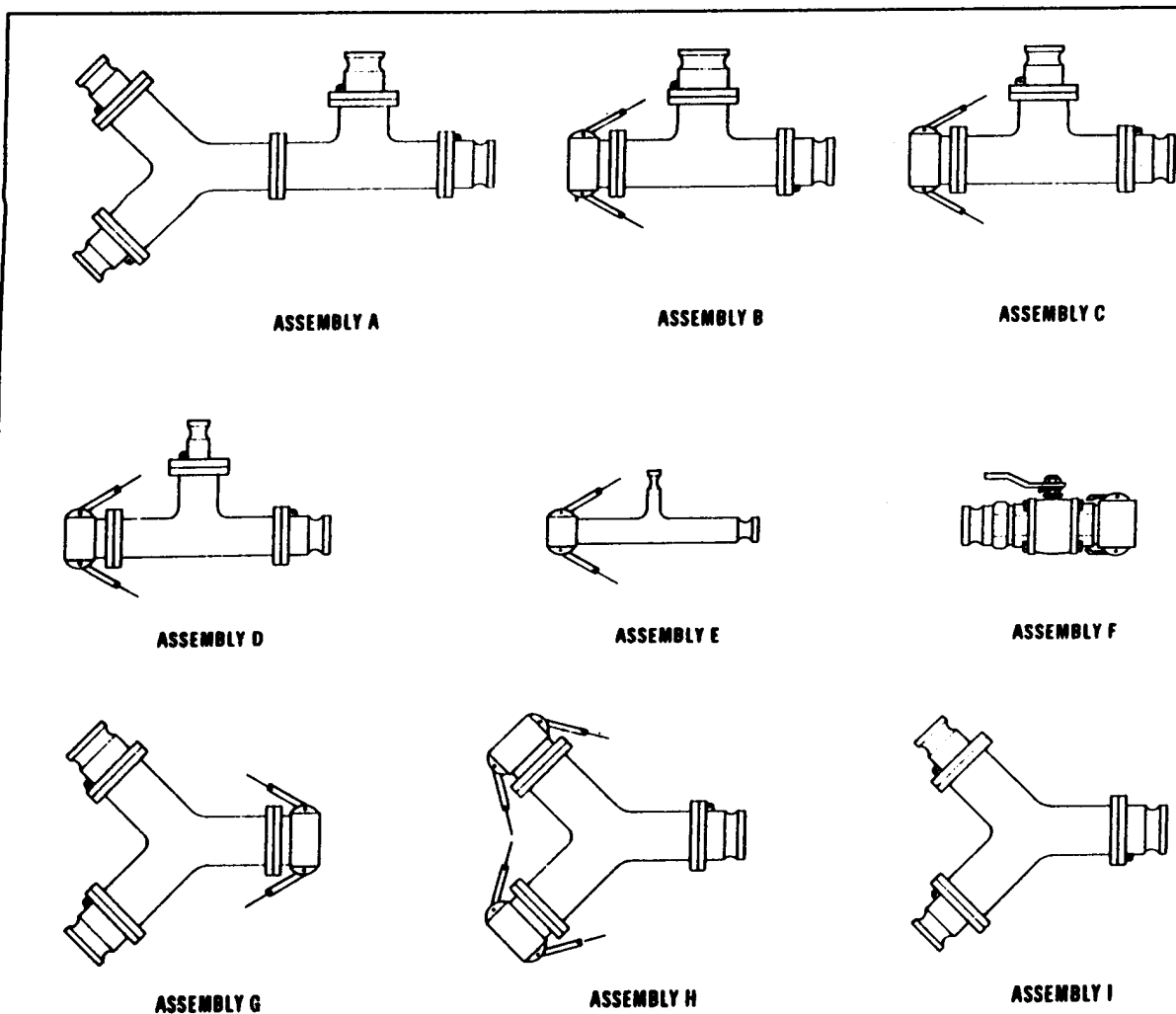
2. Hoses, Fitting Assemblies and Accessories, and Tools.

The FSSP uses suction and discharge hoses, various types of fitting assemblies and accessories, and tools. The following subparagraphs describe these components:

a. Suction and Discharge Hoses. The two types of hose assemblies used in the FSSP are suction hard hose assemblies and discharge collapsible hose assemblies. Each hose assembly has a male coupling (with a dust cap) on one end and a female coupling (with a dust plug) on the other end. Figure 1-1 shows where to use the lengths of hoses. Use the dust caps and plugs when the hose sections are not connected to the system.

b. Fitting Assemblies. The FSSP uses nine types of fitting assemblies, as shown in Figure 1-4, to connect hose sections, valves, and components. Assembly F consists of three quick-acting valve sizes. Keep dust caps and plugs on the assemblies when they are not in use. To prevent loss, attach dust caps and plugs to the hose fittings with a chain. Ensure that all fittings have gaskets. Figure 1-1 shows the location of each fitting assembly.

c. Accessories and Tools. The FSSP comes with accessories and tools so that you can connect it to different fuel transporters, other pumping assemblies, or pipelines. You also can use the accessories and tools to connect the FSSP components in many combinations; The tools used to repair hose assemblies include a hose clamp locking tool, buckles, and bandings. The accessories include an adapter for connecting a tank car to a hose assembly, a pipe clamp coupling, and a pipe coupling for connecting the FSSP to a pipeline. There are also reducers for connecting different size hoses, coupling halves (flanged and threaded) to make a number of connections, gate valves, and wye fittings.



- Assembly A.** Flanged wye and tee assembly—three 4-inch adapter flange to 3-inch male, one 4-inch male.
- Assembly B.** Tee assembly—two 4-inch male, one 4-inch female.
- Assembly C.** Tee assembly—one 4-inch female, one 4-inch male, one 4-inch adapter flange to 3-inch male.
- Assembly D.** Tee assembly—one 3-inch female, one 3-inch male, one 3-inch adapter flange to 1 1/2-inch male.
- Assembly E.** Reducer tee—one 2-inch female, one 2-inch male, one 1-inch male.

- Assembly F.** Quick-acting valve in these sizes: 3-inch, cam-locking coupling and adapter with 2-inch body; 2-inch, cam-locking coupling and adapter with 2-inch body; 1 1/2-inch cam-locking coupling and adapter with 1 1/2-inch body.
- Assembly G.** Wye assembly—two 4-inch male, one 4-inch female.
- Assembly H.** Wye assembly—two 4-inch female, one 4-inch male.
- Assembly I.** Wye assembly—one 4-inch male, two 4-inch adapter flange to 3-inch male.

Figure 1-4. Fuel system supply point fitting assemblies

3. FSSP Use.

Use the FSSP at distribution points to provide storage facilities for transferring bulk fuel from one means of transport to another. Use the FSSP at dispensing facilities for bulk reduction or fuel delivery to using vehicles. The FSSP can receive product from tank trucks, railway cars, pipelines, hose lines, and aircraft. Since it can also receive fuel from ocean tankers, it is capable of supporting beached operations. It can store 60,000 gallons of bulk petroleum. It can store even more if you add additional or larger collapsible tanks. However, this expansion requires additional hoses, fitting assemblies, and valves. You easily can move the FSSP from one place to another and divide it in half to handle two different types of fuels at two different locations as shown in Figure 1-5. You also can change it to a 10-point, rapid-refueling system for rotary aircraft. To perform this function additional equipment is required.

4. Movement of Equipment.

You can take down most of the equipment without following procedural steps or guidelines. Do it as quickly and simply as you can, but avoid spills and accidents.

First, drain the fuel from the 10,000-gallon collapsible tanks into the hose system. Close the valves at each tank so that the fuel does not flow back into them. Place a container under each tank drain port, and drain the fuel left in the tank. Stow the tanks in their carrying cases. Now, starting at the receiving point, drain the fuel from the receiving side of the system, into the discharge side. Keep the discharge pump running for suction. Disconnect the hose assemblies, and stow them in containers (when available). Be sure to install all dust caps and plugs on the hose assemblies as you dismantle them. Disconnect the discharge pump, and drain the fuel from the hose assemblies on the discharge side of the system. Disconnect the hose assemblies, and stow them in containers (when available).

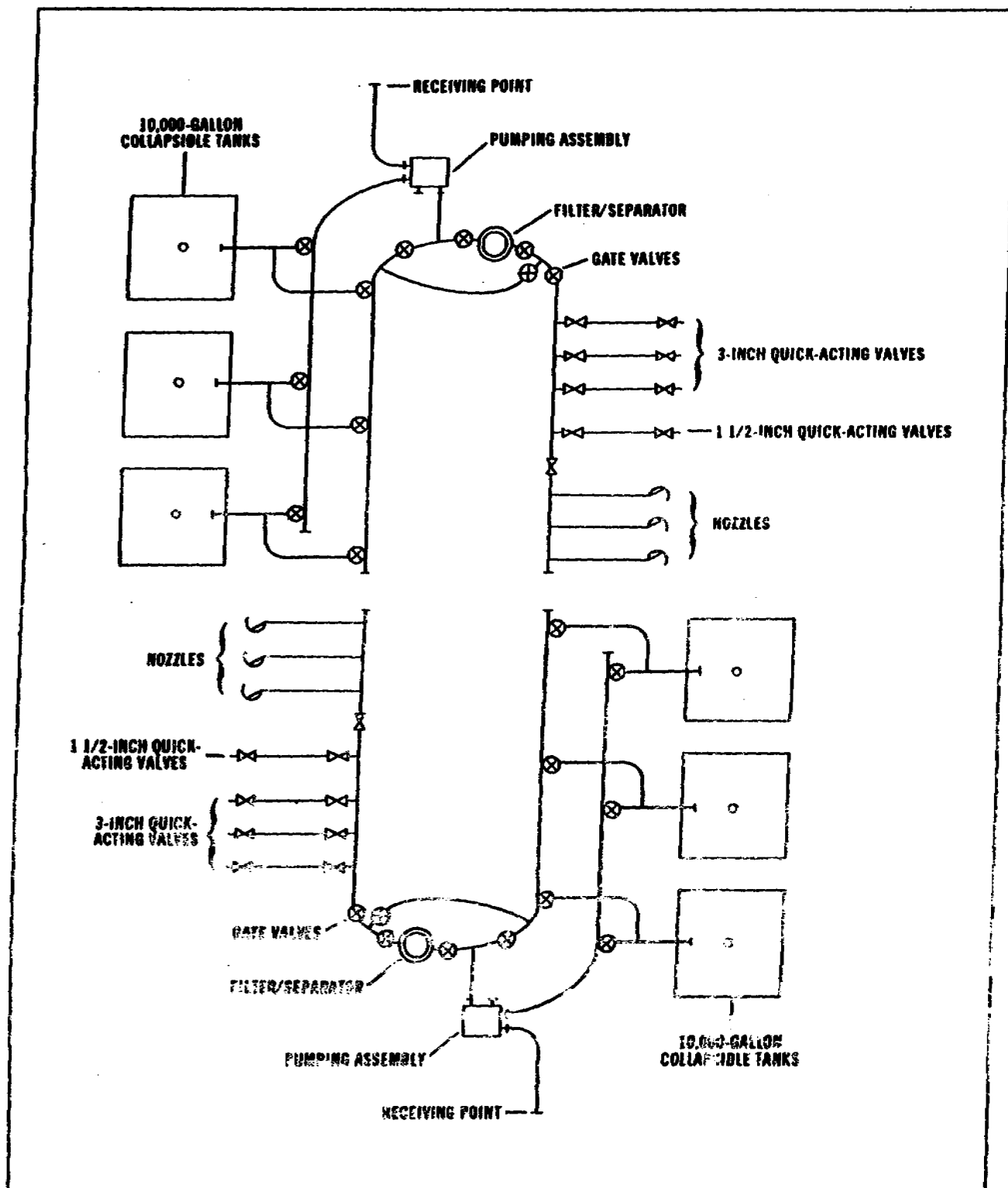


Figure 1-3. Suggested layout for a fuel system divided for handling two different fuels or for moving

5. Site Selection.

Your next-higher headquarters will assign you an area of operation. Choose your site within that area. However, do not choose a site that is near important communications and population centers that may be enemy targets. Reconnoiter your chosen site before the arrival of equipment and personnel. Locate the site as close to supported units as dispersion factors, sources of supply, and the tactical situation permit. Provide at least two storage areas with balanced stocks in each. Use vacated forward sites or existing facilities when you can. There should be two large areas (one in the front and one in the rear) that you can use for truck parking. Figure 1-6 depicts an ideal site as well as sites that you should not use.

a. Fuel System Supply Point Considerations. When you select the FSSP site, consider cover and concealment, road nets, distances between items, terrain, and site-preparation requirements. Consider dispersion factors, and make sure that the site is suitable for the fuel system layout.

(1) Cover and Concealment. Select a site for the collapsible tanks, pumps, and filter/separators that is in the woods or in a tree line where the natural shadows disguise the telltale shapes. Use camouflage nets if you have them. When you lay hose line, make use of natural terrain contours and vegetation to break up straight lines. One way that you can do this is to cut branches and stick them into the earth under the hose, and then weigh them down with the hose line. Where you have deep grass or other vegetation, bend it over the hose line to hide the hose so that it is not seen from the air.

(2) Road Nets. Choose a site for the receiving, truck bottom loading, and vehicle refueling points next to a road in the Class III fuel system supply point. You can then load or unload trucks and refuel vehicles without leaving the road nets in the supply point.

(3) Distances Between Items. You must consider the distances between items when you select the sites for the equipment in the FSSP. In other words, how far apart should you put your components? Figure 1-7 shows the usual distances between them. These distances are approximate, and they can vary with the terrain, natural cover, concealment, hose available, and road nets. However, you must put the 10,000-gallon collapsible tanks at least 40 feet apart. Choose a site that is large enough to meet the needs of product supply, but that is not so large that the handling operation becomes inefficient.

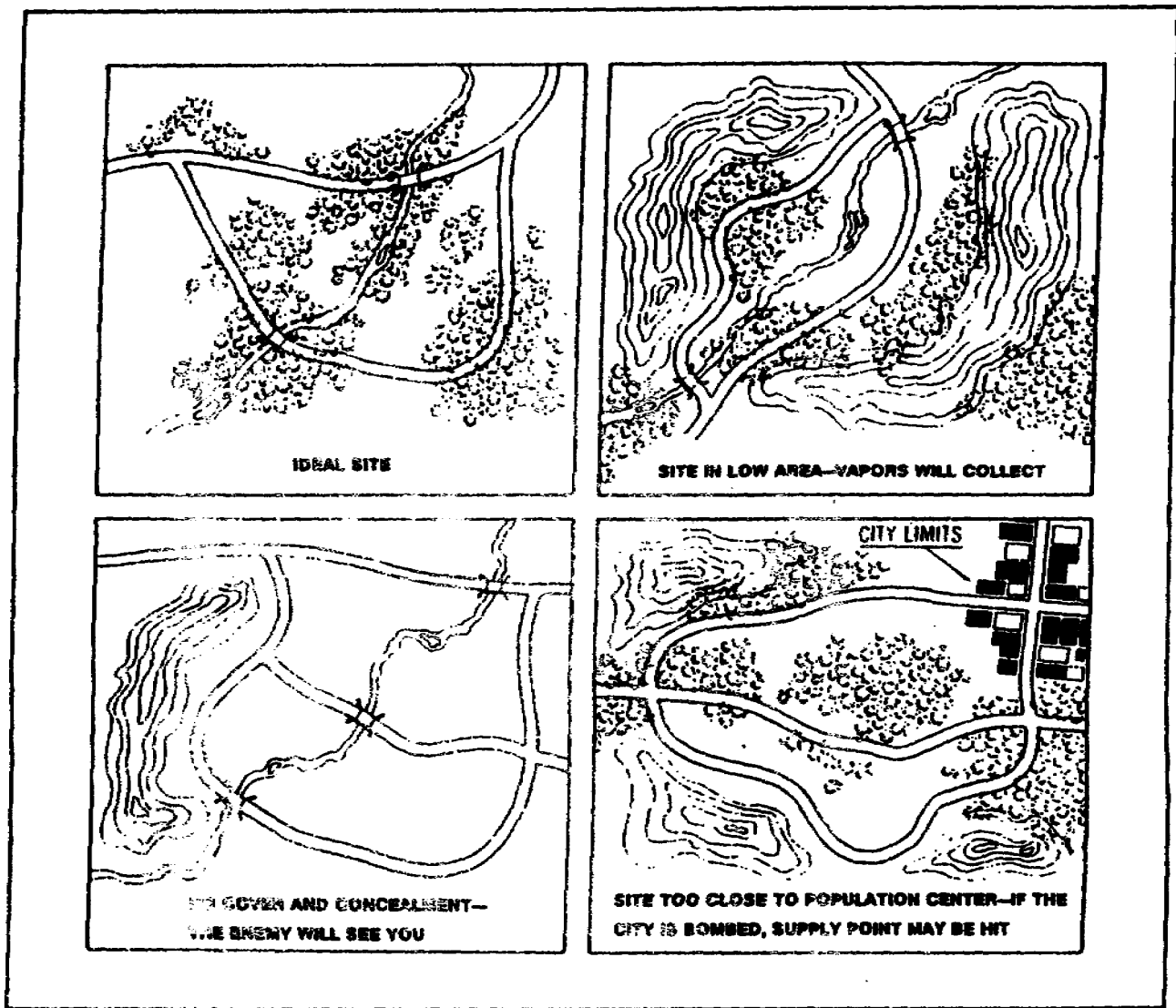


Figure 1-6. Site selection guidelines for a Class II fuel system supply point.

(4) Terrain. Select level terrain for the FSSP. Ensure that the site is well drained to prevent water damage. Avoid low areas or fill them so that vapors do not collect. Never choose a site that is uphill or downstream from installations that would be in the path of escaping fuel. Look for a tank site without slopes. A large slope may cause filled tanks to roll sideways, backward or forward. Put the pumps and filter/separators on level ground. Try to place the discharge pump at a lower level than the collapsible tanks so that there will be good suction to the pump.

FROM	TO	FEET
Receiving manifold	Receiving pump	60
Receiving pump	Manifold on first tank	60
10,000-gallon tank	10,000-gallon tank	40
Manifold on last tank	Discharge pump	60
Discharge pump	Filter/separators	40
Filter/separators	First fuel-servicing nozzle	60
Fuel-servicing nozzle	Fuel-servicing nozzle	25
Last fuel-servicing nozzle	500-gallon drum filling point	75
500-gallon drum filling point	500-gallon drum filling point	50
Last 500-gallon drum filling point	First bottom loading point	75
Bottom loading point	Bottom loading point	75

Figure 1-7. Usual distances between fuel system supply point components

(5) Site Preparation. The three major items of equipment that you have to deal with in the FSSP are the 10,000-gallon collapsible tanks, the 350-GPM pumping assemblies, and the 350-GPM filter/separators. Slope the tank sites gently toward the manifold end to help drain the tanks prior to removing them. Slope the site for each tank no more than 3 to 6 inches in the direction of the tank's fill port. Build a fire wall around each tank. Make sure that it is large enough to hold the contents of the tank and 1 foot of freeboard. To do this, build the fire wall 3 feet high and 18 inches wide at the top. Make the inside dimensions of the fire wall 26 feet by 26 feet. Maintain a distance of 3 feet from the edge of the tank to the base of the fire wall. If engineer personnel prepare the site, give them this information. Clear the pump and filter/separator sites of dry grass, leaves, and trash.

b. Standard Fuel System Supply Point Arrangements. Lay out the FSSP to take advantage of the terrain, natural cover, concealment, available hose, and road nets. If you must handle two types of fuels, such as jet propulsion 8 (JP-8) and motor gasoline (MOGAS), you may have to divide the fuel system as shown in Figure 1-5. Figures 1-8 through 1-11 show some typical arrangements. If none

of these arrangements is suitable, you may change the arrangements to fit your needs.

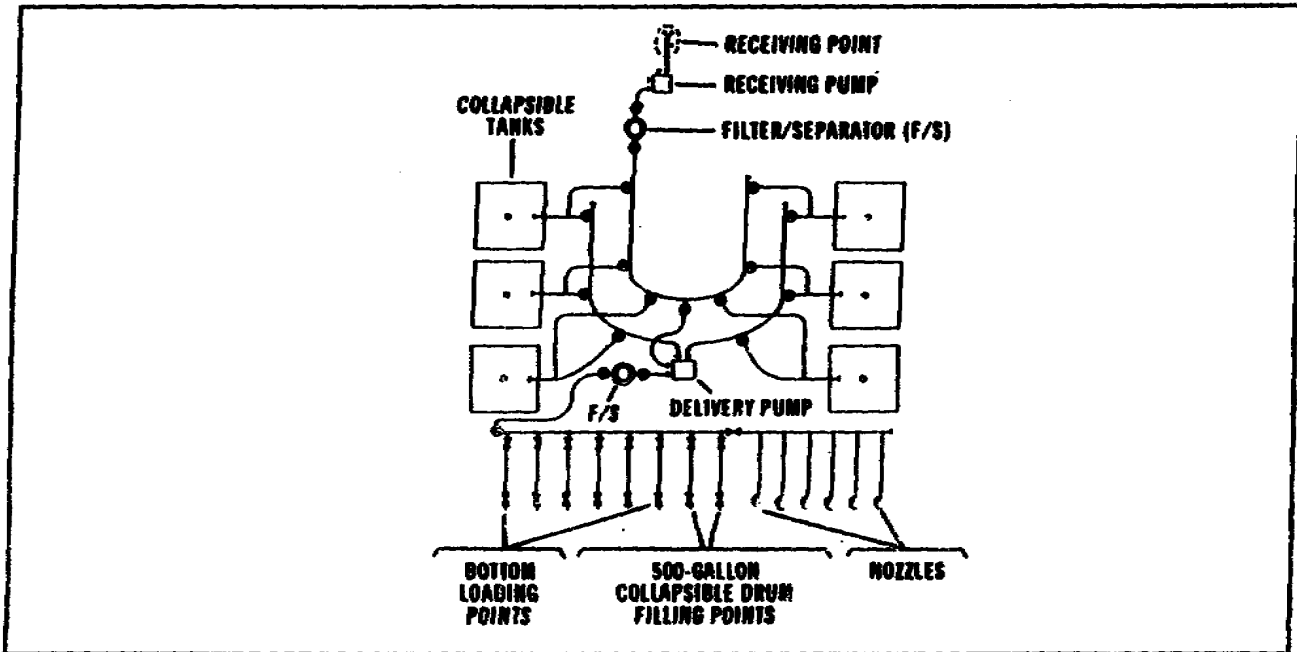


Figure 1-8. U-arrangement

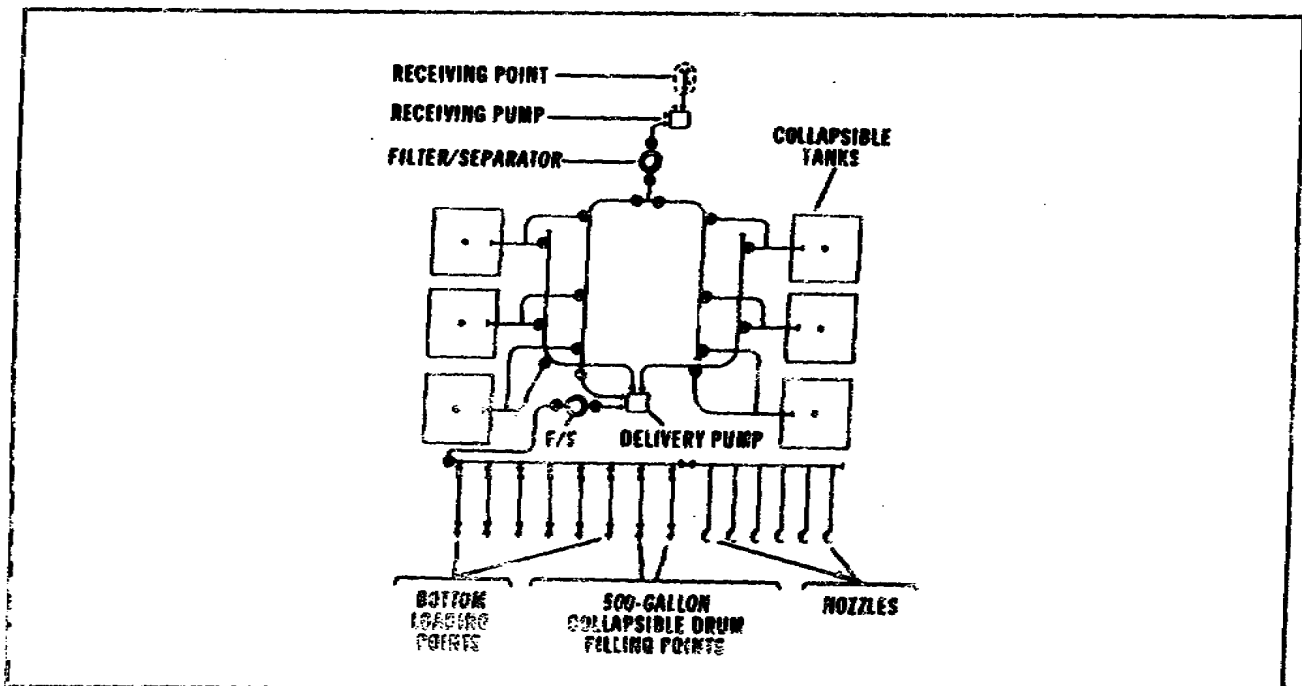


Figure 1-9. Rectangular arrangement

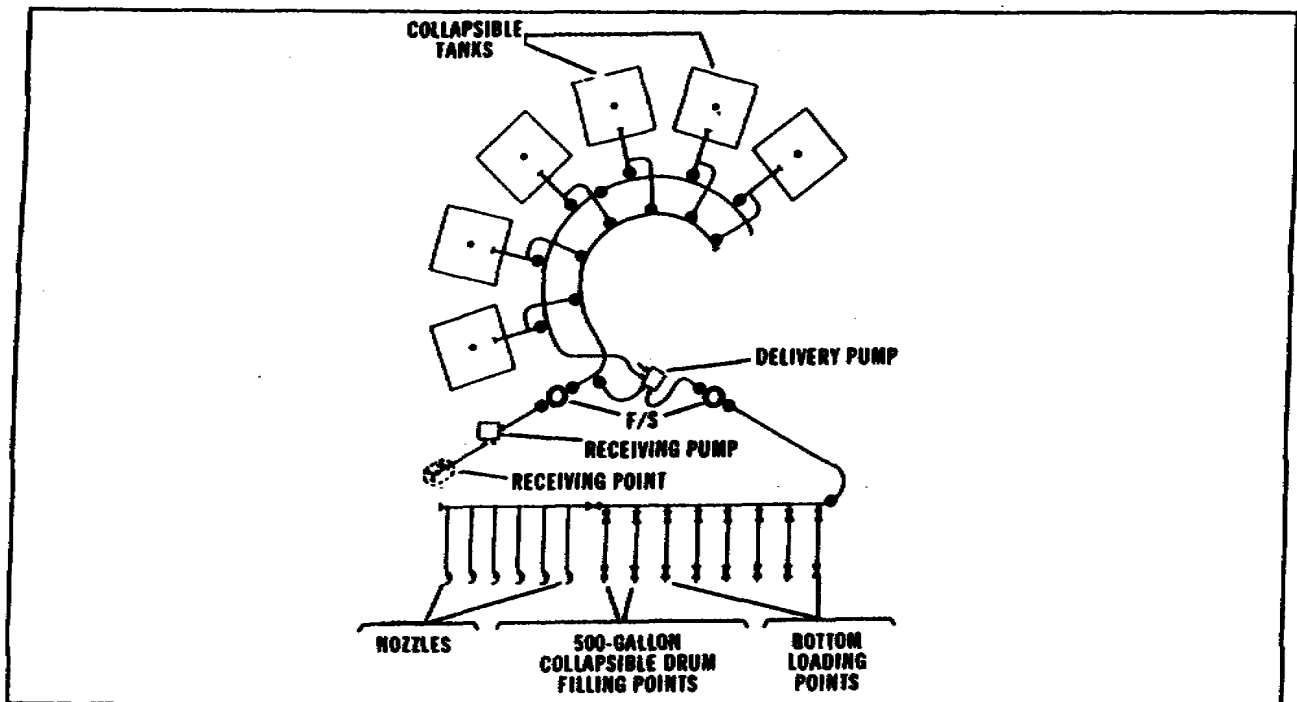


Figure 1-10. Semicircular arrangement

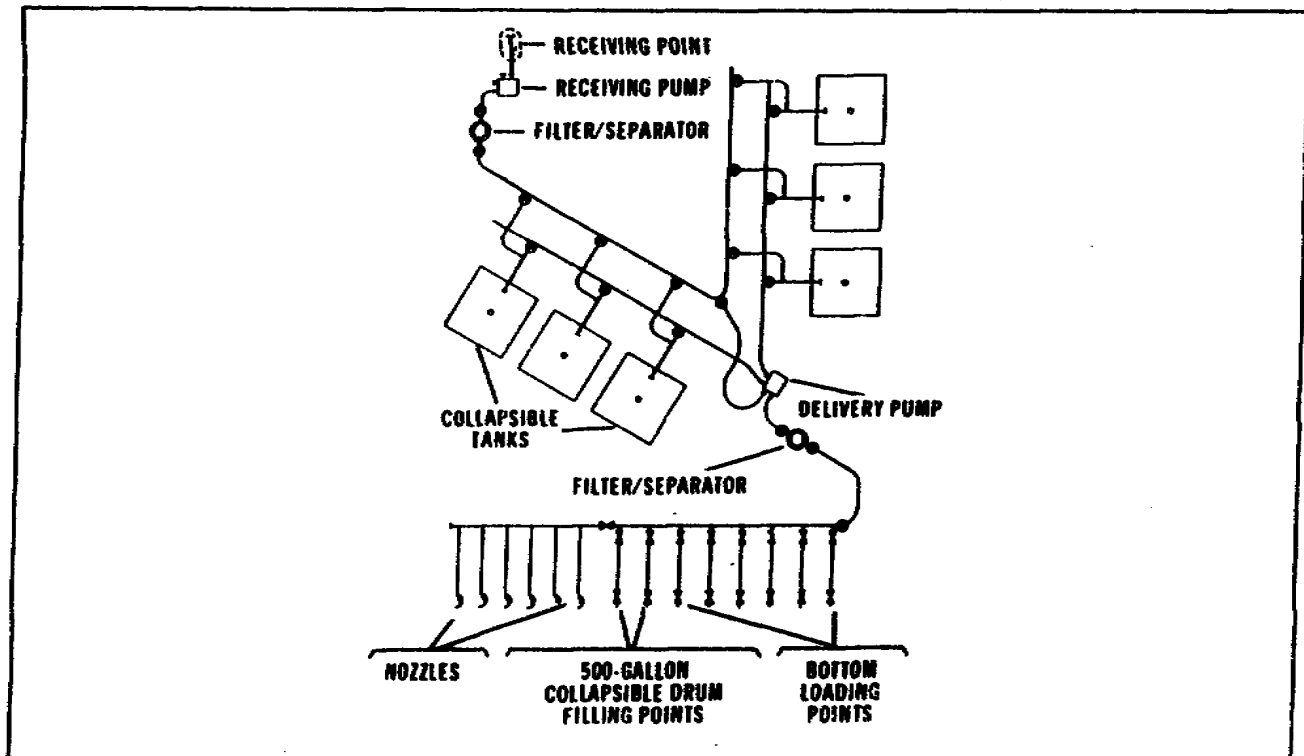


Figure 1-11. V-arrangement

c. Fuel System Supply Point Components. The best way to lay out the FSSP is to put the collapsible tanks in their prepared sites first. Put the pumping assemblies and filter/separators in place. Lay out all the fitting assemblies and hoses. Then make the connections and attach the fuel- and oil-servicing nozzles. Make sure that you have placed the components to conform to the arrangement that you chose for the fuel system. Lay out the FSSP components as discussed in the following subparagraphs:

(1) 10,000-Gallon Collapsible Tanks. To prepare the 10,000-gallon collapsible tanks, place the tanks at the prepared sites so that when you remove them from their containers and unfold them, they are in position. DO NOT step on the tanks as you unfold them. Inspect the tank fabric for cuts, snags, or other damage. Be sure that the tank filler and discharge, drain fitting, and vent pipe assemblies are in good working order.

(2) 350-GPM Pumping Assemblies. After you put the 350-GPM pumping assemblies in place, lower the retractable support and chock the wheels of each pump. Then drive a ground rod into the ground near each pump. Attach a ground cable from the rod to the pump frame.

(3) 350-GPM Filter/Separators. After you place the 350-GPM filter/separators in position, put shims under the skids to help level them. Drive a ground rod into the ground near each filter/separator, and attach a ground cable from each rod to each unit. Finally, connect a hose or a pipe to the automatic water drain port to carry water away from the unit.

(4) Fitting Assemblies and Hoses. Put all fitting assemblies and hoses in their proper places. Ensure that all suction hoses are on the receiving side of the system and that all discharge hoses are on the dispensing side. Place 3-inch discharge hose at the tank truck bottom loading points. Place 1 1/2-inch discharge hose at the 500-gallon collapsible drum filling points and 1-inch discharge hose at the vehicle refueling points. Now, starting at the collapsible tanks, connect all hose and fitting assemblies. Make sure that you leave all dust plugs and caps on the hoses and fitting assemblies until you connect them into the system.

(5) Fuel- and Oil-Servicing Nozzles. Attach the six nozzles to the 1-inch discharge hose assemblies. Make sure that each nozzle dust cap covers the spout of each nozzle. Make a support for the nozzles so that they do not lie on the ground when they are not in use.

d. Safety and Security Items. Once your supply point is set up, you must take steps to make it safe and secure. The following subparagraphs describe these steps:

(1) Checkpoints. Set up checkpoints at the operating area entrance and exit. Give personnel entering the area a safety briefing at the entrance checkpoint. Refer to the extracts of FM 10-69, Chapter 9, in Appendix B at the end of this subcourse for a fire prevention presentation that you can make at the checkpoint. Use the checkpoints not only to control the vehicles going in and out, but to account for the receipt and issue of petroleum in the supply point as well.

(2) Fire Plan. Develop a fire plan. For details, refer to the extracts of FM 10-69, Chapter 9, in Appendix B at the end of this subcourse.

(3) Signs. You must set up many different types of signs in the area of operation. Place signs identifying NO SMOKING areas and dangerous areas throughout the supply point. You also must set up speed, control, and traffic direction signs.

6. Operations.

Before you can work at an FSSP, you must understand how petroleum flows through it. Figure 1-12 shows the product moving through the FSSP. You should know where to receive fuel, which items of equipment transfer and store fuel, and where and how you issue fuel.

a. Flow Through the Fuel System Supply Point. The first step is to inspect the fuel when it arrives. The product then enters the system through the receiving manifold. It usually moves under the suction provided by one of the two 350-GPM pumps used as a receiving pump. (The product also may move under positive pressure from a transporter, pipeline, or hose line.) You may have both filter/separators installed on the delivery side of the system. In this case, the receiving pump distributes the product directly to the tanks through the delivery side of the system, and you use the other 350-GPM pump to draw fuel from the tanks and discharge it through the two filter/separators, into the hose header system. Alternatively, you may have only one filter/separator installed on the receiving side of the system. In this case, the receiving pump distributes the product to the receiving filter/separator and then to the collapsible tanks.

From this point on, regardless of whether you have both filter/separators or only one installed on the receiving side of the system, the flow of the fuel is the same except that the fuel is drawn through only one filter/separator on the discharge side of the system when one filter/separator, rather than both, is installed on the receiving side of the system.

You also can use only one 350-GPM pump to draw the product from the supply source, directly to the discharge side of the system, bypassing the storage tanks.

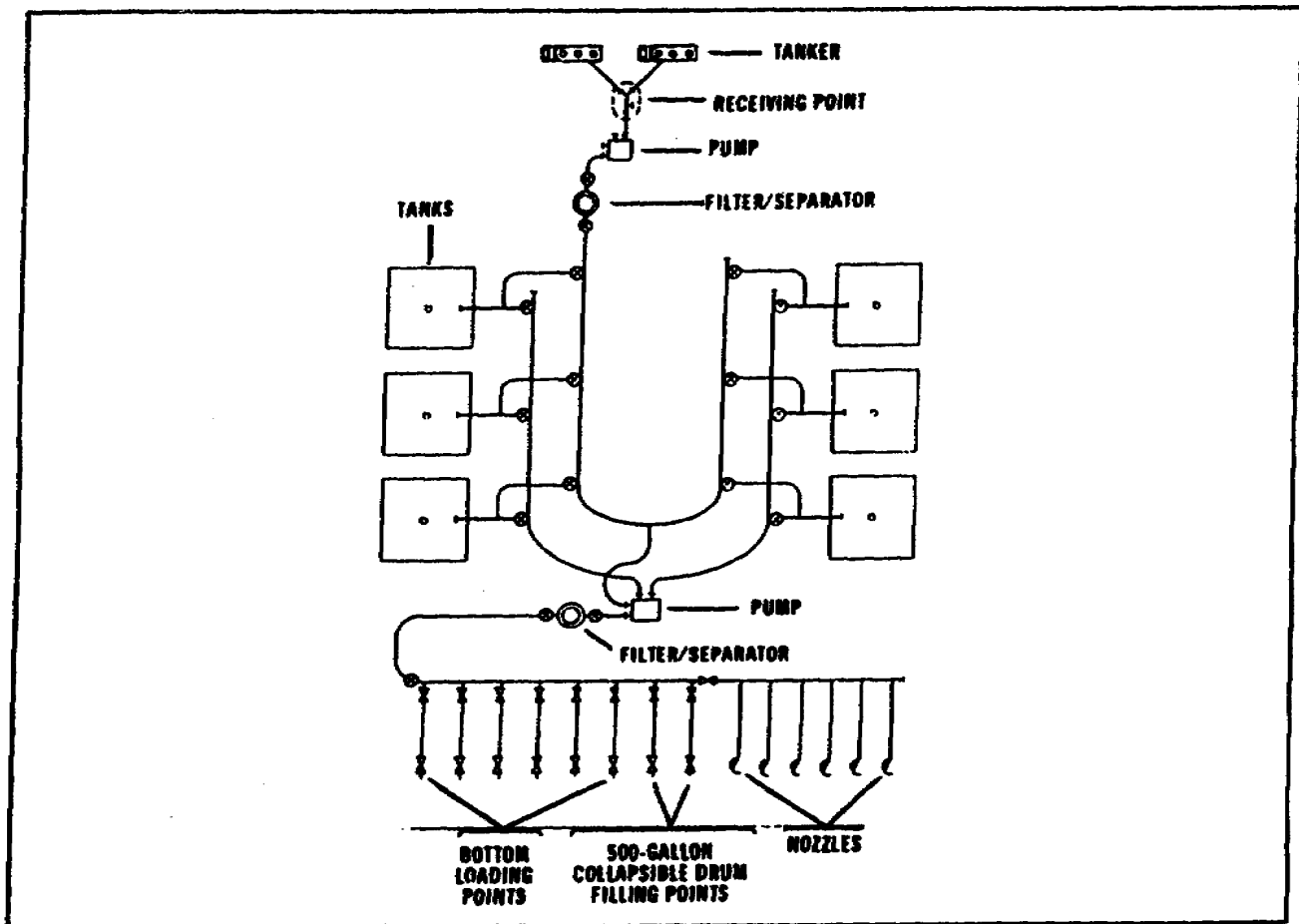


Figure 1-12. Receiving product into the fuel system supply point from tank vehicles

b. Fuel System Supply Point Operations. For a single shift, you need eight workers to operate the FSSP efficiently. Place them at certain strategic points in the operation as described in the following subparagraphs.

(1) Receiving Side. Assign two workers to the receiving manifold. Make them responsible for transferring bulk petroleum from the transporter to the fuel system. They operate all valves at the receiving point and make all necessary hose connections.

(2) Pumps and Valves. Assign three workers to the pumps and control valves. Have one worker operate each pump. Once the pumps are started, one worker can monitor them. Having one worker monitor the pumps enables the other two workers to devote their full time to valve control and fuel flow problems. Have one of these two workers control the valves on the discharge and receiving manifold of the collapsible tanks.

(3) Dispensing Side. Assign three workers to the delivery side of the system. This consists of six 5-gallon can and 55-gallon drum and vehicle filling points and two 500-gallon collapsible drum filling points. Make them responsible for dispensing petroleum and controlling the fuel flow. Have them prepare the various filling points, operate the control valves, and make all necessary hose connections. When filling tank vehicles, have the truck driver help dispense the fuel.

c. 500-Gallon Collapsible Drums. You need only two workers to fill the drums directly from the FSSP. The positioning and the tasking of the crew vary with each of these methods.

When filling drums directly from the FSSP, assign one worker to the control valves of the filling point. Make this worker responsible for controlling the flow of petroleum to the drums. Assign the other worker to the drums. Make this worker responsible for preparing the drums for filling, making all connections, and monitoring the filling operations.

d. 55-Gallon Drum Filling Operations. When you use six fuel- and oil-servicing nozzles on the FSSP, you need 10 workers to do the job well. Place one worker at each nozzle. You also need two workers to bring empty drums to the filling points and two workers to remove full drums to the bulk reduction storage area. If you have a forklift, use it to move the full drums to the storage area.

Make the six workers at the servicing nozzles responsible for bonding the nozzles to the containers and filling the drums to the proper level.

e. 5-Gallon Can Filling Operations. When you fill the cans directly from the FSSP, use essentially the same operation as for the 55-gallon drum.

PART B -STORAGE AND ISSUE OF BULK PETROLEUM

1. Storage Practices.

You should follow a number of practices when storing bulk petroleum. The following bullets list these practices:

- o Make sure that you have a separate handling system for each type of product that you store. Never mix various fuels together, and never mix leaded and unleaded gasoline.
- o Install a filter/separator in the supply line between the storage tanks and the dispensing points.
- o DO NOT store your hoses in a way that will bend them sharply over brackets. DO NOT leave hoses lying on the ground where vehicles may run over them. In addition, put dust caps and plugs on all hoses not in use.
- o Drain any water in the collapsible tanks through the drain fitting assembly.
- o Clean line strainers and nozzle screens daily. When you remove a pressure nozzle screen, disconnect the adapter first. Repair or replace damaged strainers and screens at once. Particles of rubber or lint in a screen may indicate a deteriorating hose. Sediment, scale, or rust in the nozzle screen may indicate a filter element failure.
- o Put dust caps on nozzles to keep dust, dirt, and sediment from entering the nozzle spout and contaminating the fuel.
- o Run a string across the top of collapsible tanks so that you do not overfill them. Put the string 4 feet off the ground for 3,000-and 10,000-gallon collapsible tanks, 5 feet off the ground for 20,000-gallon collapsible tanks, and 6 feet off the ground for 50,000-gallon collapsible tanks. The tank is full when the top of the tank reaches the string.
- o Follow the first-in, first-out rule so that products do not deteriorate due to prolonged storage. Issue packaged products in damaged containers first, regardless of age.
- o Inspect your facilities and operations regularly. Keep records of inspections, tests, checks, tank cleaning, and maintenance. Follow up and correct deficiencies.

2. Inspections.

Inspections are the key to finding out how well your FSSP is performing. They provide firsthand information on how the equipment and products are maintained from day to day. Inspections let you make on-the-spot corrections. They also give you information on the availability of required publications, accuracy of supply records

and procedures, supply economy practices, care of tools and equipment, and status of authorized stock levels of equipment and repair parts. Perform the following steps when inspecting your FSSP:

- o Inspect the collapsible tanks and hoses in your supply point each day for signs of leaks, tears, punctures, unusual wear, and fabric deterioration.
- o Inspect the operating equipment in the supply point daily to evaluate operator maintenance and ensure that the equipment is in good working order.
- o Inspect fire fighting equipment and drainage facilities weekly to see that they are in good condition. Make sure that the storage area is free of trash, weeds, and other combustible material.
- o Survey the traffic control system often to ensure that traffic is routed efficiently. Ensure that unnecessary equipment in the area does not hinder traffic movement or access to fire fighting equipment.

3. Filter/Separators Preventive Maintenance Checks and Services.

Filter/separators keep the product clean and free of water at the Class III fuel system supply point. The following steps describe the PMCS necessary to maintain the filter/separators:

- o Test the accuracy of the pressure differential indicator once a year.
- o Check the filter sumps each day. Remove any water.
- o Keep a daily record of pressure differential readings. Pressure differential with a clean, new element is usually 2.5 pounds per square inch (psi) or less. It should increase slowly with use.
- o Inspect the filter elements immediately if there is a sudden, significant drop in the pressure differential. It may mean that a filter element has ruptured.
- o Check the new filter elements if there is no increase in the pressure differential after several months of operation. You may find that the elements were installed improperly or that some have ruptured.
- o Change the filter elements at once when the reading on the pressure differential indicator is in the red (35 psi

and up). Change them at the end of the daily operation when the reading is in the yellow (20 to 35 psi).

- o Change the filter elements at least every 24 months or when an inspection indicates that they are ruptured or were not installed properly. Stencil the month and the year that you change the filter elements on the top of the filter/separator.
- o Check the performance of all filter/separators, regardless of the product in service, every 30 days through the submission of samples to a designated laboratory.

4. Product Consolidation and Circulation.

Consolidate or circulate product by moving it from one FSSP storage tank to another. Consolidate stocks so that several storage tanks are full and several are empty. Then, you can receive and issue large amounts of product on short notice and cut down on tank switching during receipt and issue. Circulate your stock so that the heavier product portions do not settle to the bottom of the tank and the light portions do not come to the top. Circulation ensures a good mixture of all the additives in the fuel. Perform the following procedures for consolidating fuel at the FSSP:

- o Ground the FSSP equipment. Then open the collapsible tank manifold valves from which you are transferring product.
- o Open the suction valve on the 350-GPM pumping assembly and the manifold valves on the collapsible tank that will receive the product. Ensure that all the other valves between the two collapsible tanks are open. Make your daily preventive maintenance checks on the pump. Start the pump, and idle it for three to five minutes.
- o Open the discharge valve on the pump, and increase the pump speed to the operating level. Continue pumping this way until you have finished the transfer. Figure 1-13 shows the product moving through the FSSP.
- o Idle the pump back for three to five minutes before you shut it off. Close the discharge valve on the pump and the manifold valves on the collapsible tanks while the pump is idling. Close the suction valve on the pump.

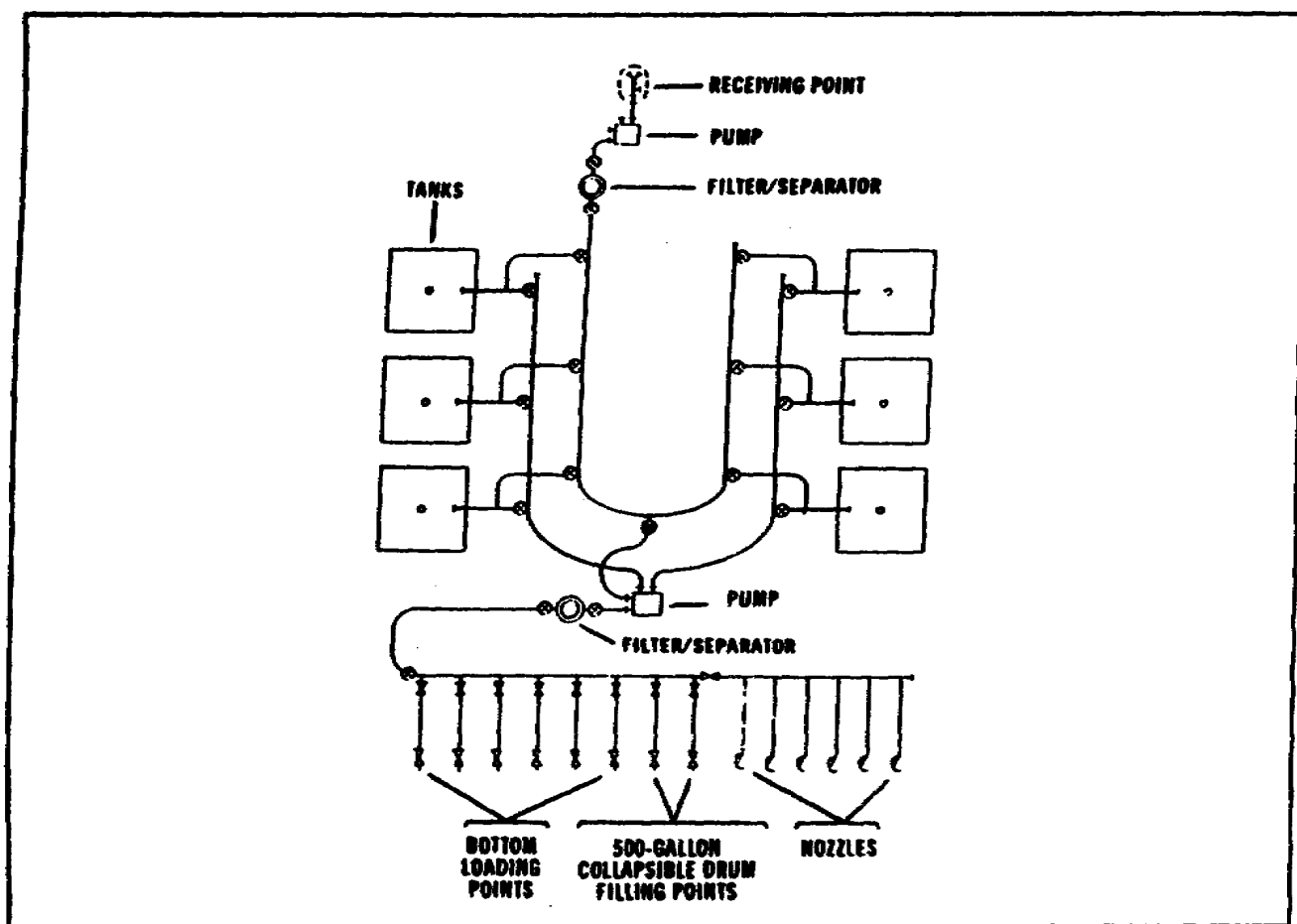


Figure 1-13. Consolidating or circulating product in the fuel system supply point

5. Emergency Tank Repair.

If any of the collapsible tanks develop a leak, repair them at once with emergency repair items. There are two repair methods. One uses sealing plugs, and the other uses sealing clamps. The one that you use depends upon the size of the cut, tear, or rupture. Whatever method you use, ensure that you put on rubber gloves and the protective hood before starting the repair operation.

a. Sealing Plugs. Use a sealing plug if the hole in the tank is three-eighths of an inch or smaller. Figure 1-14 and the following steps show how to repair a tank with a sealing plug:

- o Insert a wood plug in the hole to stop the leak temporarily. Then use the rotary cutter to cut a clean edge around the hole.

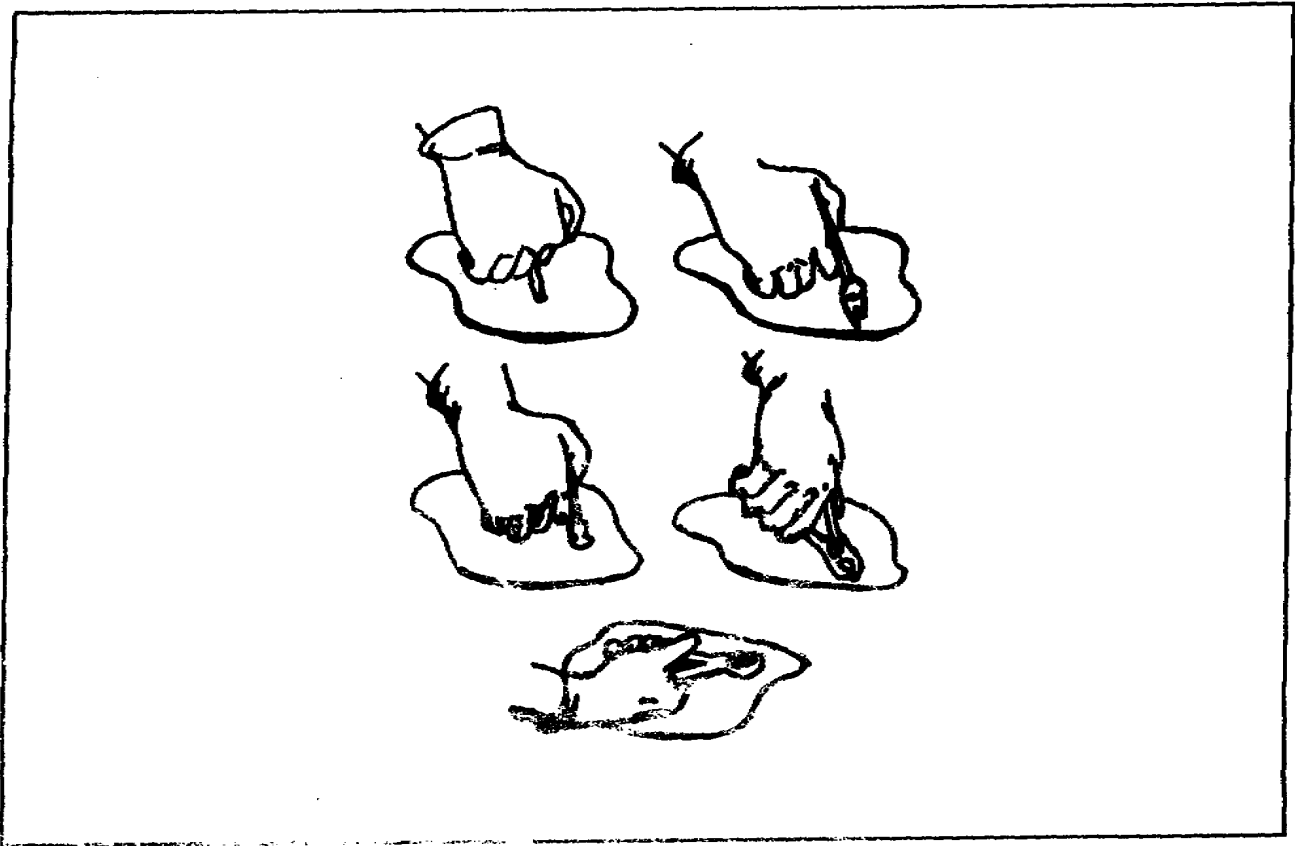


Figure 1-14. Application of sealing plugs

- o Push the cone-shaped end of a sealing plug assembly through the hole, and pull the sealing plug tight against the interior of the tank wall.
- o Tighten the sealing plug assembly nut with pliers, and cut off the excess sealing plug assembly shank.

b. Sealing Clamps. Use a sealing clamp if the hole is larger than three-eighths of an inch. Repairs with sealing clamps are more permanent than those with sealing plugs. Sealing clamps use the tank skin as a gasket-type sealant until you can send the tank to the general support maintenance facility. You may install sealing clamps when the tank is full, but install them as quickly as you can. Perform the following steps and those shown in Figure 1-15 to repair a sealing clamp:

- o Select a sealing clamp. The bottom plate of the clamp that you select should fit through the tear at its narrowest dimensions. Slit the tear slightly to insert the clamp bottom plate if necessary.

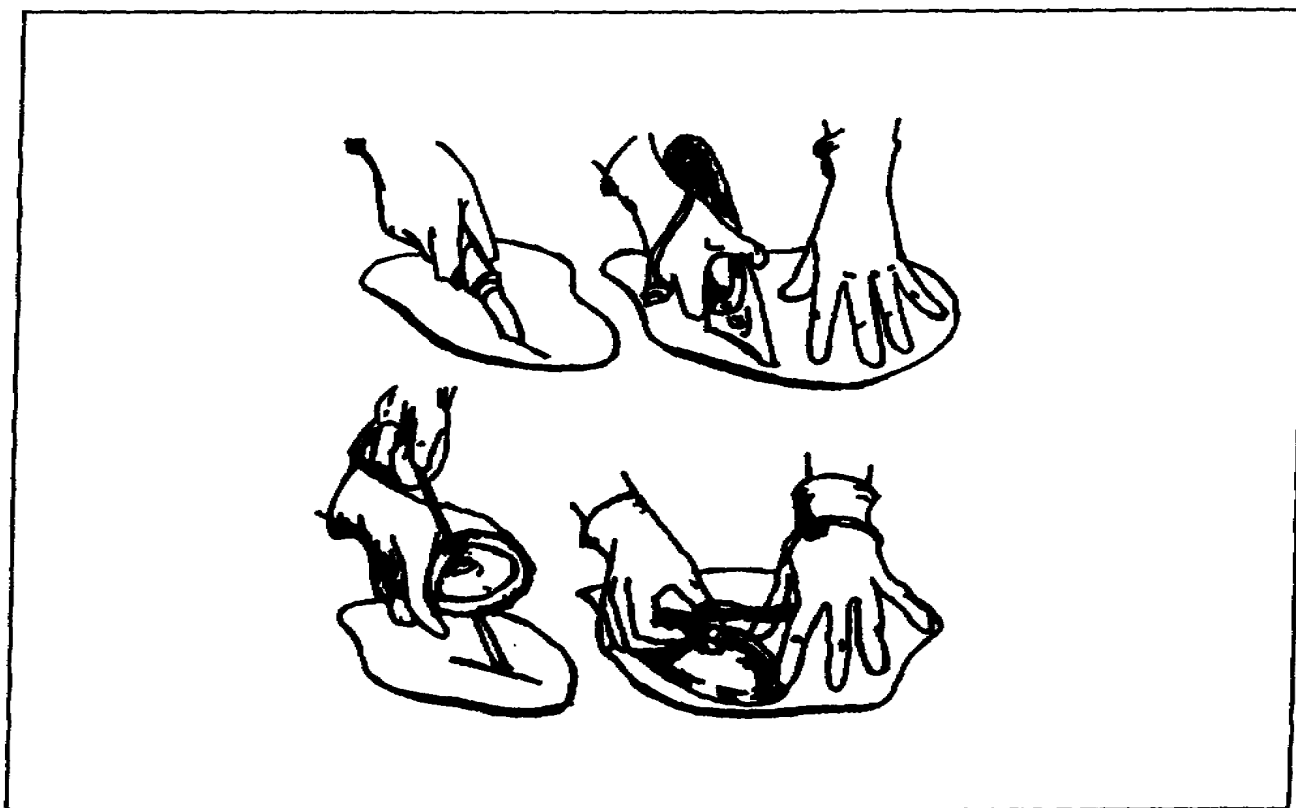


Figure 1-15. Application of sealing clamps

- o Fold the hinged stud down, and insert the bottom plate through the rupture.
- o Straighten the stud, and rotate the plate so that the long dimension of the rupture is along the plate's length.
- o Slide the upper plate of the sealing clamp over the stud, and install and tighten the wingnut.

6. Disposal of Excess.

If you are in the continental United States (CONUS) or an overseas activity and you have an excess in bulk or packaged fuels of 500 gallons or more per product grade, report the excess by sending a message to the Commander, United States Army General Materiel and Petroleum Activity (USAGMPA). Include in your message the quantity, location, type of product, national stock number (NSN), and latest laboratory test results. If you are in an overseas command, also report the excess to the appropriate Defense Fuel Supply Center (DFSC) field office or to the Joint Petroleum Office (JPO).

7. 10,000-Gallon Collapsible Tank Preventive Maintenance Checks and Services.

A number of PMCS are necessary for the 10,000-gallon collapsible tank. Within designated intervals, perform the before (B), during (D), and after (A) PMCS in the order listed, as shown in Figure 1-16.

Item No.	Interval			Item to be Inspected	Procedures check for and have repaired or adjusted as necessary	For Readiness Reporting Equipment is Not Ready/Available If:
	B	D	A			
1	•			Installation Area	Inspect the installation area to prevent accumulation of stones, sticks and other sharp objects that might cause punctures and leaks.	
2	•	•	•	Tank Body	Inspect tank body for tears, punctures and leaks.	
3	•	•	•	Filler and Discharge Assembly	Inspect the filler and discharge assembly for evidence of damage or leakage.	
4	•	•	•	Vent Pipe Assembly	Inspect the vent pipe assembly for evidence of damage or leakage. Inspect pressure relief valve for freedom of operation.	
5	•	•		Drain Fitting Assembly	Inspect the area near the drain fitting assembly for evidence of leakage. The assembly is located on the bottom surface of the tank at its lowest end.	
6	•	•	•	Filler and Discharge Valve and Hose Assembly	Inspect the hose assembly for leaks, cuts and tears. Check fittings for distortion or damaged gaskets.	
7	•	•	•	Control Valves	Inspect the control valves for bent or binding stem and leakage.	
8			•	Tank Inside	<p>WARNING</p> <p>The sludge deposited by fuel in the storage tank gives off toxic as well as explosive vapors and may cause lead poisoning through inhalation. When cleaning tanks, ample ventilation should be provided to carry off the fumes. The sludge should be buried where it is not likely to be uncovered. If fuel, particularly leaded gasoline, is stored for an extended period of time, a heavy sludge can accumulate in the bottom of the tank. The sludge can be removed by opening the access plate after which the tank should be thoroughly flushed with water. The access plate may be removed by removing the hexagon head capscrews and washers. Excess water should be drained from the tank. The interior tank coating can be protected against cracking by sloshing a gallon or two of gasoline inside the tank after cleaning. Excess gasoline should be removed prior to returning the tank to service.</p>	

Figure 1-16. 10,000-gallon collapsible tank preventive maintenance checks and services

8. Issue Consolidation.

Issuing bulk petroleum is perhaps your most important responsibility at the Class III fuel system supply point. Your purpose in the field is to get large quantities of petroleum to the units that you support. In the theater of operations, you issue liquid petroleum in bulk as far forward as the tactical situation permits. Usually, the units that you support pick up bulk petroleum from the supply point in their own vehicles. When you use the FSSP, make your bulk issues from the bottom loading points. The following paragraphs discuss step-by-step procedures for issuing bulk petroleum to tank vehicles and tank cars:

9. Preliminary Procedures.

You should take a number of steps before issuing bulk petroleum from your Class III fuel system supply point. The following subparagraphs discuss these preliminary steps:

a. Issue Schedule Preparation. Prepare an issue schedule before any transporter arrives at the supply point. Start by telling your customer how much and what type of product you have on hand. Then tell him when he can pick up product at the supply point. If your transporters are delivering the product, tell the customer when it will arrive at his supply point. Try to avoid delays and interruptions when you are scheduling issues. In other words, do not have more transporters at your supply point than you can handle at one time. Also, ensure that you have enough product on hand to fill all your orders.

b. Equipment Inspection. Ensure that the discharging equipment in the supply point is in good working condition. Inspect your pumps, filter/separators, collapsible tanks, hose, manifolds, valves, and fittings daily to see that they are free of leaks and contamination.

c. Transporter Spotting. When the transporter arrives at the supply point, check the customer's issue request to ensure that the transporter is authorized properly. Position the transporter at an issue point.

d. Transporter Inspection. Open the manhole or dome cover to inspect the transporter. As part of your inspection, perform the following:

- o Check inside and outside the tank for holes, cracks, or loose plates. Ensure that there are no leaks in the tank. See that the tank mounts properly to the frame and is safe to operate on the road.

- o Inspect inside the tank for cleanliness. If you see residue such as rust, sand, or dirt on the bottom of the tank, reject the transporter and have it cleaned. Let only authorized personnel familiar with tank-cleaning procedures and safeguards enter a tank.
- o Check the tank interior for foreign objects such as tools, bolts, or old seals. Have authorized personnel remove objects from the tank. Some objects do not contaminate the product, but they may damage valves. Also, look for residual product in the tank. If you see any, remove it before you fill the tank.
- o Inspect the fuel delivery system of the transporter for damage. On tank cars, check the dome, dome cover, bottom outlet chamber, and safety valve to ensure that they are in good condition. See that the vent holes in the dome cover are open and free of dirt.
- o Ensure that the tank care outlet valve seats and seals properly. To do this, first place a drain tub under the bottom outlet chamber. Open and close the outlet valve several times by working the valve rod handle or handwheel located inside the dome. If the valve does not seat properly, reject the care. Report the malfunction to the local transportation officer for scheduled repairs. In an emergency, you may load the tank car without repairing the valve, but report the broken valve to the unit receiving the tank car so that unloading can be done through the dome. In any case, schedule the tank care for repair as soon as possible. Ensure that the outlet valve is closed after you check it.
- o Ensure that the product last carried in the tank is the same as the product that you are going to put into it. If you think that it is necessary, flush the transporter tank with a small amount of product to remove any traces of the last product as well as rust and scale. Collect this product, and put it into a waste container.

LESSON

PRACTICE EXERCISE

The following items will test your grasp of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answer with the answer key that follows. If you answer any item incorrectly, study again that part of the lesson which contains the portion involved.

Situation: You are a petroleum section supervisor checking the components of an FSSP which you will use under normal operating conditions. Use this situation and Figure 1-17 to answer questions 1 through 5.

1. You ensure that the FSSP has how many 350-GPM pumping assemblies?
 - A. One.
 - B. Two.
 - C. Three.
 - D. Four.
2. Your FSSP uses how many different fitting assemblies?
 - A. Two.
 - B. Five.
 - C. Eight.
 - D. Nine.
3. You can divide your FSSP into how many different locations?
 - A. Two.
 - B. Three.
 - C. Four.
 - D. Five.

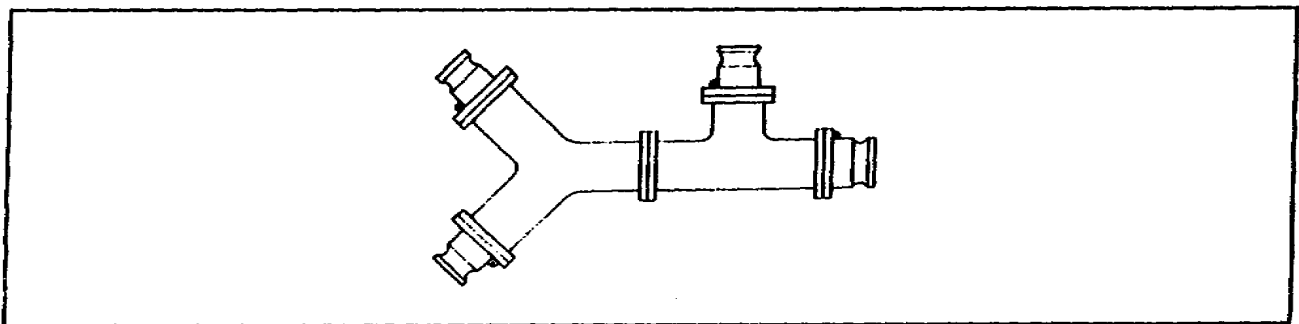


Figure 1-17. Assembly

4. The assembly shown in Figure 1-17 is which of the following types?
- A. Wye.
 - B. Quick-acting valve.
 - C. Reducer tee.
 - D. Flanged wye and tee.
5. How many 4-inch adapter flanges to 3-inch male couplings does the assembly shown in Figure 1-17 contain?
- A. One.
 - B. Two.
 - C. Three.
 - D. Four.
6. Which of the following procedures is your first step in moving the FSSP?
- A. Draining the fuel from the 10,000-gallon collapsible tanks into the hose system.
 - B. Closing the valves at each tank so that fuel does not flow back into the tanks.
 - C. Draining fuel left in the tank into containers under the tank drain ports.
 - D. Draining fuel from the hose assemblies and disconnecting them.

Situation: You are a petroleum section supervisor supervising the selection of a site for a Class III fuel system supply point. Use this situation and Figure 1-18 to answer question 7.

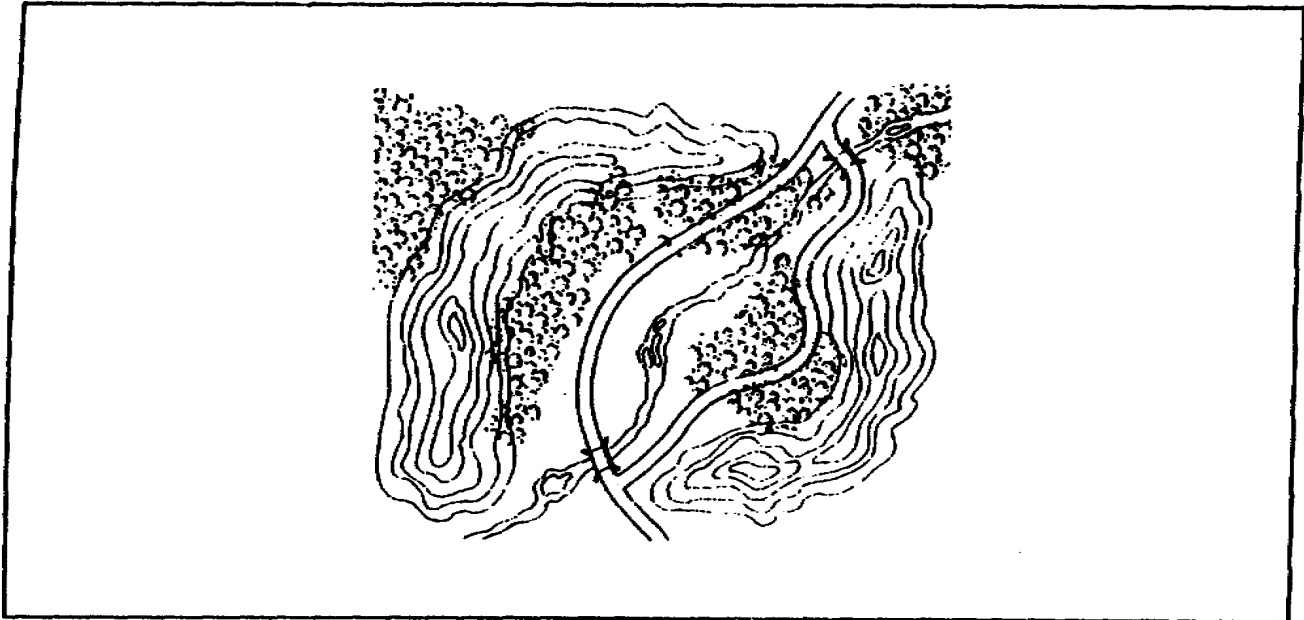


Figure 1-18. Possible site for a Class III fuel system supply point

7. You place your receiving manifold the usual distance from the receiving pump. This is a distance of how many feet?
- A. 25.
 - B. 50.
 - C. 60.
 - D. 75.

Situation: You are a petroleum section supervisor supervising the operation of a Class III fuel system supply point. Use this situation to answer question 8.

8. For a single shift, you need how many workers to operate your FSSP efficiently?
- A. Three.
 - B. Four.
 - C. Eight.
 - D. Nine.

Situation: You are a petroleum section supervisor supervising the receipt, storage, and issue of bulk petroleum. Use this situation to answer questions 9 and 10.

9. When storing bulk petroleum products, how often do you clean line strainers and nozzle screens?
- A. Daily.
 - B. Weekly.
 - C. Monthly.
 - D. Quarterly.
10. You review your personnel's record of pressure differential readings. With a clean, new element, the pressure differential is usually how many psi?
- A. 1.0
 - B. 1.5 or less.
 - C. 2.0
 - D. 2.5 or less.

LESSON

PRACTICE EXERCISE

ANSWER KEY AND FEEDBACK

<u>Item</u>	<u>Correct Answer and Feedback</u>
-------------	------------------------------------

- | | |
|----|---------|
| 1. | B. Two. |
|----|---------|

The FSSP is not issued as a complete system. The major components are issued as separate items of equipment to add to the flexibility of the system. The number of major components depends on the size and configuration of the system. An FSSP normally consists of a receiving manifold, two 350-GPM pumping assemblies, two 350-GPM filter/separators, six 10,000-gallon collapsible tanks, six bottom loading points, two 500-gallon collapsible drum filling points, and six 5-gallon can and 55-gallon drum filling and vehicle refueling points. (Page 1-2, para 1)

- | | |
|----|----------|
| 2. | D. Nine. |
|----|----------|

Approximately 2,400 feet of hose and nine types of fitting assemblies connect these fuel system components. When you requisition an FSSP, you receive only the hoses, fitting assemblies, tools, and accessories to connect the above components. (Page 1-2, para 1)

- | | |
|----|---------|
| 3. | A. Two. |
|----|---------|

You can easily move the FSSP from one place to another and divide it in half to handle two different types of fuels at two different locations as shown in Figure 1-5. (Page 1-9, para 3)

- | | |
|----|-------------------------|
| 4. | D. Flanged wye and tee. |
|----|-------------------------|

Figure 1-4 shows nine types of fitting assemblies used in the FSSP. The assembly shown in Figure 1-17 is a flanged wye and tee assembly (Assembly A). (Page 1-8, Figure 1-4)

- | | |
|----|-----------|
| 5. | C. Three. |
|----|-----------|

According to Figure 1-4, Assembly A has three 4-inch adapter flanges to 3-inch male coupling. (Page 1-8, Figure 1-4)

Item Correct Answer and Feedback

6. A. Draining the fuel from the 10,000-gallon collapsible tanks into the hose system.

Your first step in moving the FSSP is to drain the fuel from the collapsible tanks into the hose system. (Page 1-9, para 4)

7. C. 60.

Figure 1-7 shows the usual distances between FSSP components. According to Figure 1-7, you maintain a distance of 60 feet between the receiving manifold and the receiving pump. (Page 1-13, Figure 1-7)

8. C. Eight.

For a single shift, you need eight workers to operate the FSSP efficiently. Place them at certain strategic points in the operation. (Page 1-18, para 6b)

9. A. Daily.

Clean line strainers and nozzle screens daily. When you remove the screen in a pressure nozzle, disconnect the adapter first. Repair or replace damaged strainers and screens at once. Particles of rubber or lint in a screen may indicate a deteriorating hose. Sediment, scale, or rust in the nozzle screen may indicate filter element failure. (Page 1-20, para 1)

10. D. 2.5.

Keep a daily record of pressure differential readings. The pressure differential with a clean, new element is usually 2.5 psi or less. It should increase slowly with use. (Page 1-21, para 3)